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**Identifying Aggregate Supply and Demand Shocks in Small Open Economies: Empirical
Evidence from African Countries**

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Abstract

This paper uses a tri-variate structural VAR with a long-run identification scheme, akin to the Blanchard and Quah method, to identify external and domestic supply and demand shocks in 22 African countries between 1980 and 2005. Domestic supply shocks are found to be the most important factor contributing over 70% to output fluctuations in these countries, with external shocks playing a relatively minor role. A partial correlation analysis between the identified shocks and a measure of the fiscal policies of the countries revealed that the fiscal policies pursued by most of the countries during the period are counter-cyclical.

JEL Classification: E62, F41, F43

Key Words: African countries; Structural VAR

1. Introduction

This paper contributes to the on-going debate over the disappointing economic performance of many African countries over recent decades with respect to economic growth (see, for example, Easterly and Levine, 1997), by focusing on the identification of the sources of the economic shocks faced by these economies between 1980 and 2005, in order to examine the country-specific constraints on economic growth and potential policy options.

Despite the optimism about Africa's economic potential in the 1960s and early 1970s (Enke, 1963; Kamark, 1976) for most African countries, the 1980s are considered as 'a lost decade' with slow, and even negative, growth commonplace (Fisher, 1991). For example, in 1957 Ghana, then the wealthiest nation in sub-Saharan Africa, had a per capita income almost equal to that of South Korea (US\$ 490 against US\$ 491 in 1980 dollars), but by the early 1980s, Ghana's annual income per head had fallen by nearly 20 per cent to US\$400, while South Korea's per capita GDP was, by then, over US\$ 2,000. The UNDP's 1990 Human Development Report suggests that South Korea had an annual purchasing power per head ten times greater than Ghana (US\$ 4,832 against US\$ 481) based on 1987 statistics (The Economist, 26 May, 1990, p.81). Furthermore this was not just a country-specific problem, but an African problem. Collier and Gunning (1999), for example, note that African economic performance had been markedly worse than that of other regions, during the 1980s as per capita GDP declined by 1.3 percent per annum, five percent below the average for all low income developing countries. During 1990-94 the decline accelerated to 1.8 percent per annum which, widened up the gap between the average of all low income countries to 6.2 percent. Since the mid-1990s economic performance in Africa seems to have been improving, with GDP growth in sub-Saharan Africa rising to about six percent per annum, while inflation has been in single digits, a much improved performance perhaps partly attributable to structural adjustment programmes sponsored by the IMF and the World Bank.

To identify the potential economic shocks faced by the African countries since 1980 we undertake a tri-variate VAR analysis, following Dungey and Pagan (2000). For small open economies, like those in Africa, where external shocks are likely to be at least as important as domestic shocks in influencing the evolution of output growth and inflation, the tri-variate VAR is preferred to Blanchard and Quah's (1989) more usual bi-variate VAR. In this framework in addition to domestic output growth and inflation, world output growth is also included in the model. This variable is assumed to be an important exogenous determinant of individual country exports, and therefore fluctuations in world output growth are likely to have significant effects on domestic output growth and inflation. A second contribution to the existing literature is to identify the contribution of national fiscal policies by a partial correlation analysis between the estimated shocks and a measure of fiscal policies of the countries studied.

The rest of the paper is organised as follows. The next section discusses the identification of aggregate supply and demand shocks within a structural VAR. Section 3 analyses the data from our sample of 22 African countries and the results from the trivariate-VAR analysis. Section 4 concludes.

2. Aggregate Supply and Demand Shocks within an SVAR

The SVAR methodology imposes structural restrictions, based on economic theory (Hoffmaister et al 1998), on a Vector Autoregressive (VAR) model. In particular, in a bi-variate VAR context, Blanchard and Quah (1989) interpret the permanent shocks as aggregate supply shocks and transitory shocks as aggregate demand shocks. In an open economy context, a third-order VAR is necessary to capture potential shocks from the rest of the world on domestic output growth and inflation (Dungey and Pagan, 2000).

Therefore let y_t^* , y_t and π_t represent the log of real foreign output, the log of real domestic output and the domestic inflation rate, respectively. Then a tri-variate autoregressive (VAR) model can be set up to represent the small open economies of Africa as follows:

$$\Delta y_t^* = \sum_{j=1}^k a_{11j} \Delta y_{t-j}^* + e_{1t} \quad (1)$$

$$\Delta y_t = \sum_{j=0}^k a_{21j} \Delta y_{t-j}^* + \sum_{j=1}^k a_{22j} \Delta y_{t-j} + \sum_{j=1}^k a_{23j} \Delta \pi_{t-j} + e_{2t} \quad (2)$$

$$\Delta \pi_t = \sum_{j=0}^k a_{31j} \Delta y_{t-j}^* + \sum_{j=1}^k a_{32j} \Delta y_{t-j} + \sum_{j=1}^k a_{33j} \Delta \pi_{t-j} + e_{3t} \quad (3)$$

where the constant terms are suppressed for notational convenience and the variables are differenced sufficiently to achieve stationarity. If the domestic economy is assumed to be small, then it is reasonable to assume that this economy has no effect on the world output, and therefore the foreign output equation includes neither current or lagged values of the other variables. The small country assumption also means that domestic output and inflation are allowed to depend on the current and past values of foreign output. The residuals e_{1t} , e_{2t} and e_{3t} are assumed to be related to each other through different types of shocks, which are foreign shocks, v_t , domestic demand shocks, η_t and domestic supply shocks, ε_t . Since these shocks are not observable, they need to be identified from the VAR residuals. Let the relationship between the residuals and the innovations be given by

$$\begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \end{bmatrix} = \begin{bmatrix} g_{11} & g_{12} & g_{13} \\ g_{21} & g_{22} & g_{23} \\ g_{31} & g_{32} & g_{33} \end{bmatrix} \begin{bmatrix} v_t \\ \varepsilon_t \\ \eta_t \end{bmatrix} \quad (4)$$

In the above system, there are fifteen unknowns to identify. These are nine elements, g_{ij} , of matrix G linking the VAR residuals and the structural innovations, three variances σ_v^2 , σ_ε^2 , σ_η^2 and three covariances $\sigma_{v\varepsilon}^2$, $\sigma_{\varepsilon\eta}^2$, $\sigma_{\eta v}^2$ in the variance-covariance matrix, Σ , of the structural innovations. From equation (4) the variance-covariance matrix of the VAR residuals Σ_e is denoted by

$$\Sigma_e = G \Sigma_s G' \quad (5)$$

The elements of Σ_e provides six of the fifteen restrictions required for exact identification of the system. In addition, following the Blanchard-Quah methodology, it is assumed that all variances are unity, i.e. $\sigma_v^2 = \sigma_\varepsilon^2 = \sigma_\eta^2 = 1$ and all co-variances are zero, $\sigma_{v\varepsilon}^2 = \sigma_{\varepsilon\eta}^2 = \sigma_{\eta v}^2 = 0$. The penultimate two restrictions are that the domestic supply shocks ε_t and domestic demand shocks η_t have no impact on the large country, so that both g_{12} and g_{13} are zero. Finally, domestic demand shocks have no long-run effects on domestic output, so that:

$$g_{23} [1 - \sum_{i=1}^k a_{33i}] + g_{33} [1 - \sum_{i=1}^k a_{23i}] = 0 \quad (6)$$

These restrictions are adequate to identify the structural system. Impulse response functions and variance decomposition analysis of the output effects of the structural shocks are considered with the view to investigate the plausibility of the identification presented here.

Given that the domestic country is assumed to be small, world output growth is taken to be exogenous and therefore, domestic shocks do not affect world output. A positive shock to foreign growth, however, perhaps from a global technological improvement, would raise domestic output growth through two possible channels. There would be a direct effect of higher demand for home exports as world income rose and an indirect effect, through a more favourable terms of trade for the home country as import prices fall relative to export prices. A positive domestic supply shock directly and permanently increases output. As long-run neutrality of aggregate demand is assumed demand shocks have no effect on the long-run path of domestic supply.

3. African growth: response to external and internal shocks

3.1 The Data Set

To estimate the SVAR model quarterly data is obtained from the IMF's International Financial Statistics database, covering the period from 1980Q1 to 2005Q4 and comprises of foreign (or world) real GDP plus domestic real GDP and the consumer prices indices (CPI) for each of the 22 African countries in the sample. Foreign real GDP is represented by US output, which is highly and significantly correlated with world output (correlation coefficient of 0.73). The time series were first logged and then subjected to a battery of unit root tests that included the ADF, PP and KPSS tests to identify their level of integration. Table 1 shows that the tests rejected the stationarity of the series in levels, but failed to reject stationarity in first differences. In addition, Table 1 also reports Johansen cointegration tests between the logarithms of domestic prices, domestic GDP, and foreign GDP for each country, and shows that there is no cointegration and therefore the use of the SVAR methodology is appropriate for each of the sample countries.

3.2 SVAR Results

The impulse response functions show the direction, magnitude and time path of domestic output growth and inflation from shocks emanating from world output, domestic demand and domestic supply. Figure 1 shows these GDP growth and inflation profiles for each of the 22 countries, where the dotted lines denote the five per cent confidence bands.

Output growth of these countries does not seem to be very sensitive to the positive external shock from world GDP growth. This maybe a reflection of the general movement towards more flexible exchange rates (see Ahmad, et al 2011 and Alba, et al 2011) by many of these economies, so providing them with greater insulation from real foreign shocks. In fact only three countries' output responded to the world GDP shock: Botswana, Central Africa, and to a lesser extent, Egypt. This effect is probably due to the structure of these countries exports. For example, Botswana's and Central African Republic's main exports are diamonds, the demand for which is likely to be sensitive to income growth in the industrial countries and Egypt is increasingly becoming an important gold exporting country. Jin, et al (1994) reported similar findings for Korea in the 1990s. For some countries, such as Ethiopia and Nigeria the positive world output shock lead to an initial fall in

domestic growth which persisted until the tenth quarter and sixth quarter after the shock, respectively. Similar results are reported by Ahmed and Park (1994) for a set of developed countries. With the exception of Gabon, world output shocks had no effect on domestic inflation. In Gabon inflation rises at a diminishing rate for ten quarters, to be 10% higher than before the shock.

A positive domestic supply shock results, as expected, in a persistent rise in the growth of real output from the period contemporaneous to the shock up to the tenth quarter in all the countries. The magnitude, however, varies from country to country. Zambia, for example, recorded a 3% positive response during the period immediately after the shock, whereas Gabon, Ghana, Libya, Malawi, Mauritania and Tanzania's output responded by a 2% rise in the period contemporaneous to the shock. The rest of the countries recorded a rise of about 1% in output due to the domestic supply shock, except for Egypt, Mauritius and Tunisia, where the immediate response to the shock was less than 0.5%. The degree of persistence also varies among the countries. In Algeria, Botswana, Gabon, Ghana, Libya, Malawi and Tanzania, the response of the output was to rise by between 3% and 4% by the second or sixth quarter, where it mostly remained until the tenth quarter. The effect of the domestic supply shock on inflation rates was small, although this result may also reflect the role of price distortions in some of these economies. Countries that operate some form of price control, such as Benin, Cameroon, Central Africa, Gabon and Senegal, recorded a rise in inflation in response to a positive shock to domestic supply. Other countries, such as Algeria, Egypt, Ghana and Tunisia, where there are few price controls, did record a decline inflation of between 1% and 1.5% as a result of a positive domestic supply shock, albeit in some cases insignificant.

A positive domestic demand shock has no permanent effect on real GDP in most of the sample countries, the exceptions being Benin and Senegal, where output growth, although very small is sustained for over ten quarters. The demand shock, however, has a much greater effect on inflation, inducing an immediate, positive and significant rise in inflation in all the countries, except Gabon. For most countries the rise in inflation is between 1% and 2%, although in three countries – Ghana, Malawi and Zambia it is very much higher. In Ghana inflation rises immediately by 2% and is 10% higher ten quarters later and on a rising trend. In Malawi inflation jumps immediately by 2.5% and is 7.5% higher after ten quarters and still rising. In Zambia inflation jumps immediately by 15% and remains about 15% higher after ten quarters.

Impulse response analysis is useful in considering the signs and magnitude of responses to specific shocks, however, the relative importance of shocks for given variable fluctuations is better assessed through the variance decompositions. Table 2 presents the variance decomposition of real output and inflation to world GDP and domestic supply and demand shocks. Foreign shocks have not significantly impacted on the domestic output of these countries, except in Egypt, Gabon and Ghana where the foreign shock accounted for more than 10% of domestic output variations. Gabon recorded the highest of 14% after three years. The domestic supply shock is by far the most important source of domestic real output variation in all the 22 countries, however, its relative significance seems to decline over time in some countries. For example, in Nigeria and Senegal, the supply shocks initially accounted for about 99% of output fluctuations, but its contribution in both countries declined to about 68% after six years. The influence of demand shocks on domestic output varies across the countries, but its relative importance is generally low, accounting for less than 20%

of output variations in all the countries, except in Senegal where the influence of the demand shock on output is about 30%.

The most important source of inflation is the demand shock, which accounts for between 50% and 90% of inflation variation in all countries, with the exception of Gabon. The country where the demand shock has the largest influence on inflation is Zambia, where demand shocks accounts for between 100% and 96% of the variation in inflation. In general the external world output shock has had rather less impact on inflation variation in most of the countries, with the exceptions of Gabon and South Africa, accounting for between 3% and 7% of their inflation variation. For Gabon, external shocks initially account for 98% of the inflation variation, before falling to about 80% after three years. South African inflation variation is also highly dependent on foreign output shocks, which account for 21% of inflation variation after two years. This level of external dependence is probably explained by the fact that South Africa's largest trading partner, accounting for about a third of her exports and imports, is the USA. The contribution to inflation of domestic supply shocks varies from one country to another. In Algeria, Central Africa, Benin, Ethiopia, Malawi and Senegal, between 20% and over 40% of variations in inflation are attributable to the domestic supply shocks. Domestic supply shocks are, however, responsible for less than 10% of inflation in Botswana, Egypt, Kenya, Libya, Mauritania, Mauritius, Nigeria, Tanzania, Tunisia, Uganda and Zambia.

3.3 Fiscal policy

Given the impact of the three shocks on inflation and domestic output growth, it is also interesting to consider the possible impact fiscal policy has had on eliminating or magnifying the impact of such shocks. In order to undertake this kind of analysis, a measure of the fiscal is needed. In this regard we follow Kaminsky et al (2004) and Ilzetzki and Vegh (2008), where fiscal policy is measured from the perspective of the potential instruments of fiscal policy, rather than from the outcomes (which could lie outside the policy makers' control). Since data on tax rates are not available, or indeed a reliable measure of the tax burden in developing countries, government consumption is used as the measure of the fiscal policy stance. The variable is sourced from the Worldbank Development Indicators database.

A partial correlation analysis between the estimated shocks and government consumption are reported in Table 3, which shows that for the majority of countries fiscal policy is counter-cyclical (see also Diallo, 2009), as indicated by negative and significant correlation coefficients between the demand shock and the government consumption. Of the 22 countries, 19 show negative correlation coefficients (four of which are not statistically significant at the 10% level), while three, Central Africa, Gabon and Morocco are positive (between 0.22 and 0.46) and significant. The most counter-cyclical fiscal policy countries seem to be Malawi and Mauritius, with correlation coefficients of -0.95 and -0.76 respectively. The relationship between domestic supply shocks and fiscal policy is usually positive (20 out of 22 countries) and statistically significant. The two exceptions are Central Africa and Morocco, with partial correlation coefficients of -0.26 and -0.44 respectively, both of which are significant at the 5% per cent level. This suggests that in most countries government consumption rises with positive output shocks, suggesting that much of the additional supply is bought up by the public sector, rather than by the private sector.

4. Conclusion

This paper has investigated the effects of external, demand and supply shocks on output growth and inflation in 22 African countries. On the whole, domestic supply shocks are by far the most important of the shocks in accounting for between 70% and 95% of movements in domestic output. This finding may suggest that economic policies that aim at alleviating country-specific supply-side constraints would most likely help in raising the economies' rate of economic growth.

Foreign supply shocks have produced positive and significant output responses in Botswana, Egypt, Gabon, and Tunisia, perhaps reflecting the importance of solid minerals in these countries' exports. Domestic demand shocks did not produce any significant response in real output, except in Senegal and Benin, although inflation did respond positively to the demand shocks in almost all the countries.

Finally, a partial correlation analysis between domestic supply and demand shocks and government consumption, used as a measure of the countries' fiscal stance, indicated that fiscal policy undertaken by these countries during the sample period was primarily counter-cyclical, and that extra output produced as a result of a positive supply shock was largely absorbed by the public sector.

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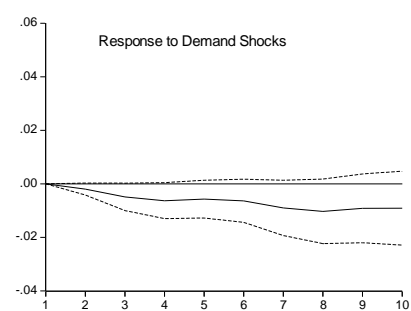
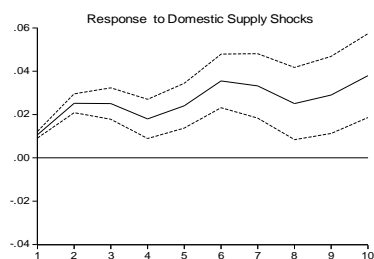
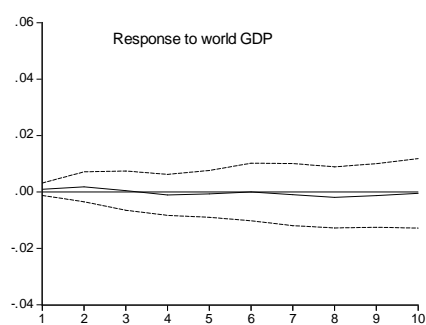
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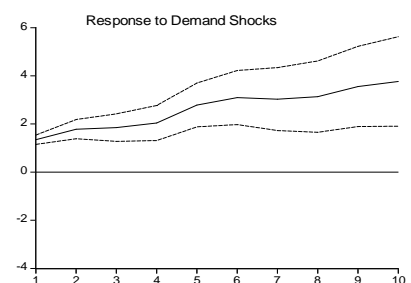
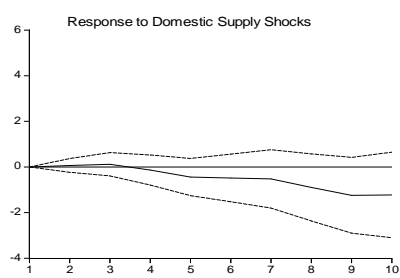
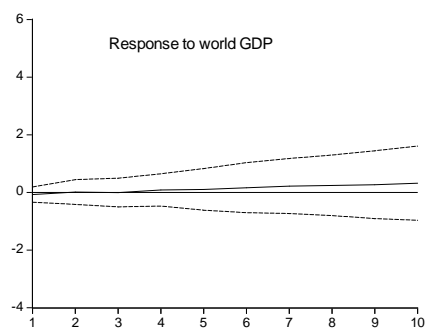
Figure 1. Impulse Responses

(1) Algeria

Real GDP Responses

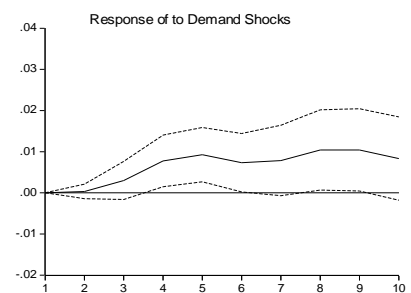
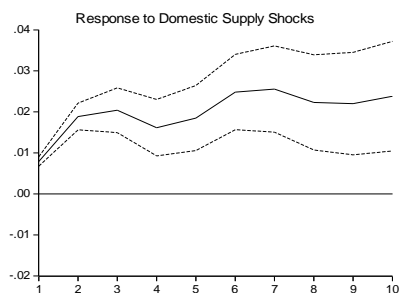
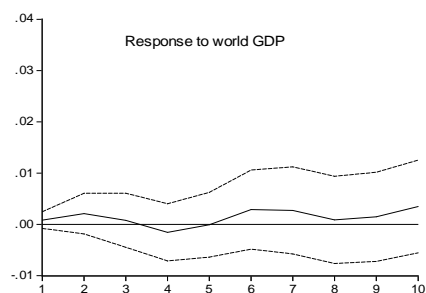


Inflation Responses

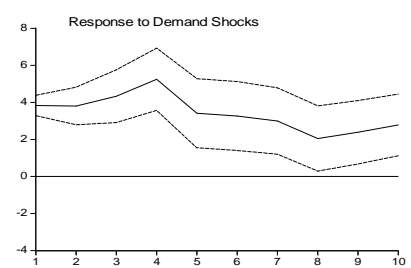
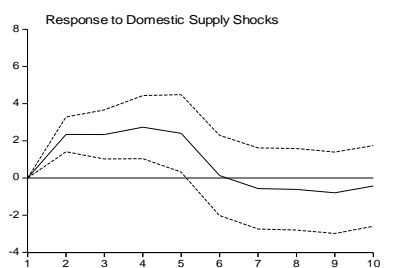
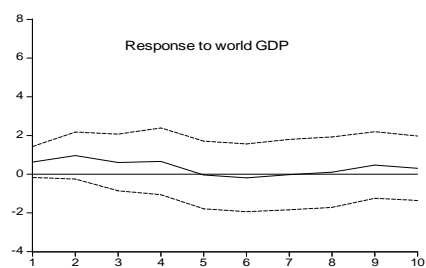


(2) Benin

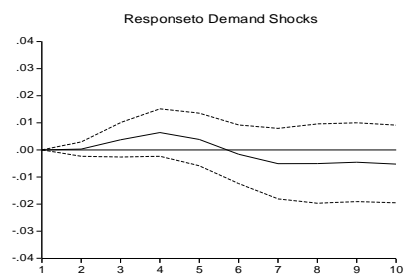
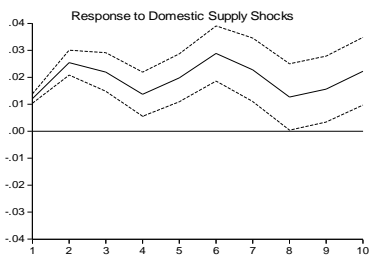
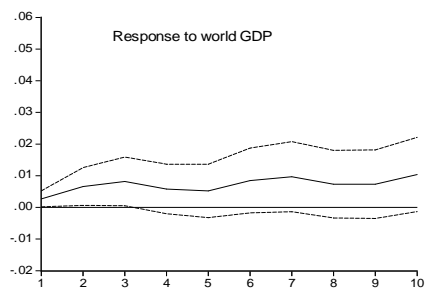
Real GDP Responses



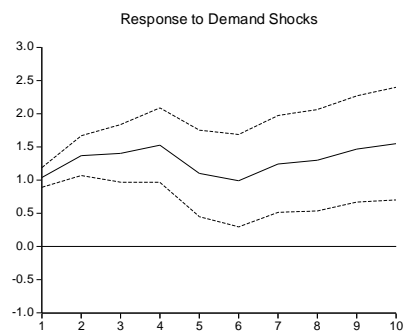
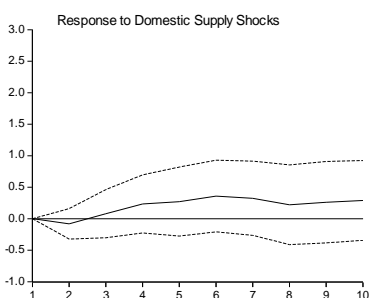
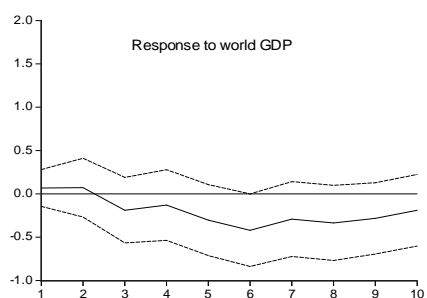
Inflation Responses



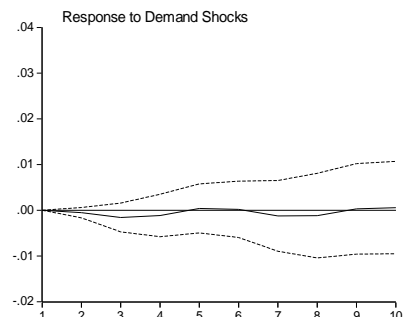
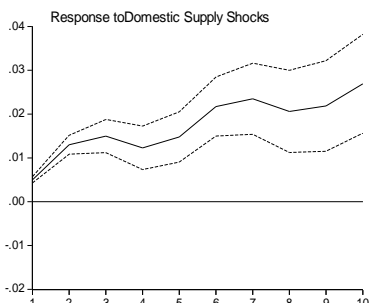
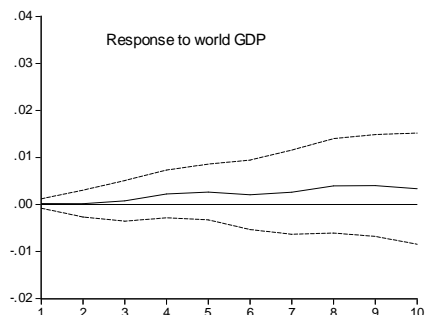
(3) Botswana Real GDP Responses



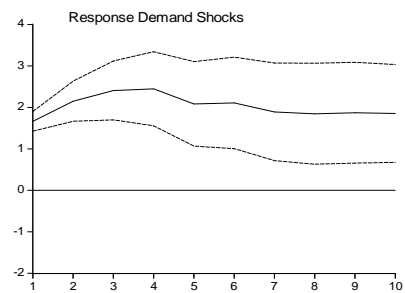
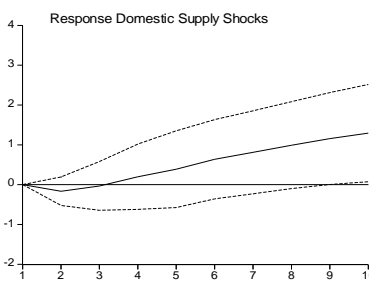
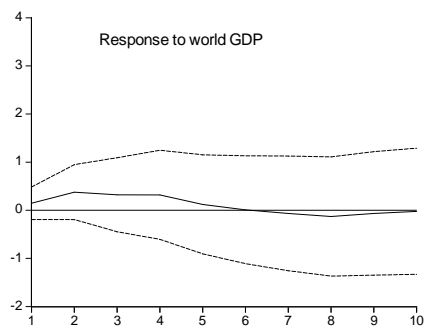
Inflation Responses



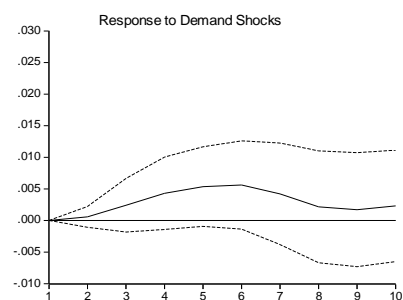
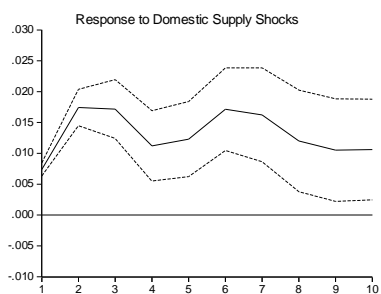
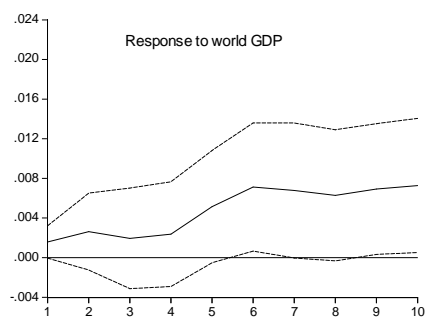
(4) Cameroon Real GDP Responses



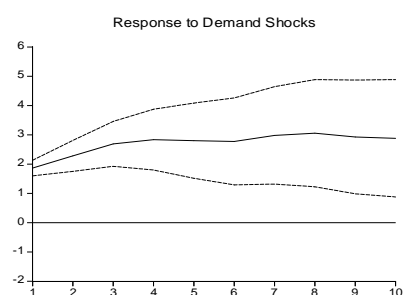
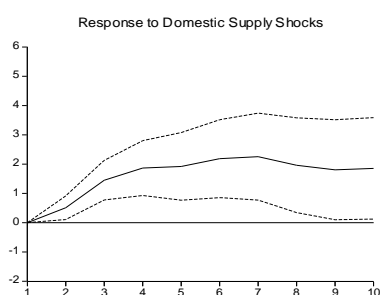
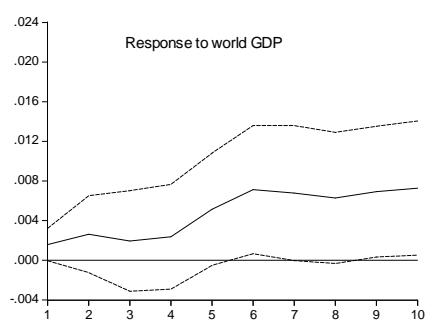
Inflation Responses



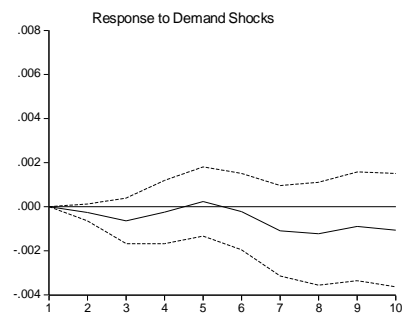
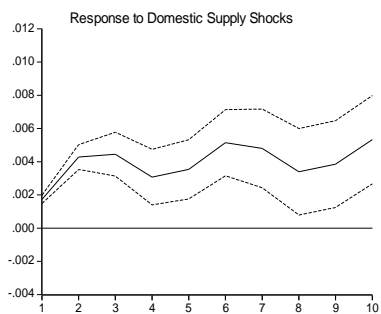
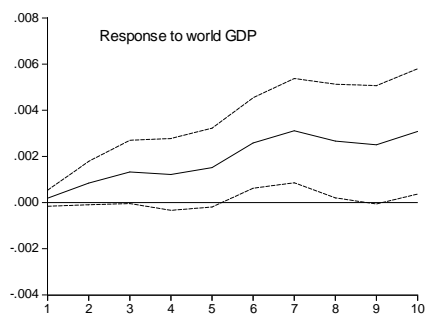
(5) Central Africa Real GDP Responses



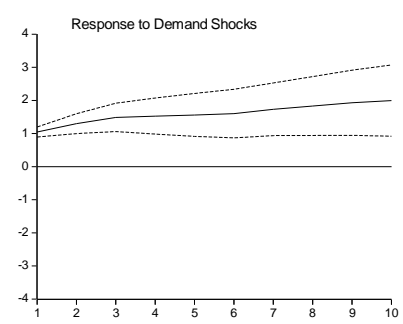
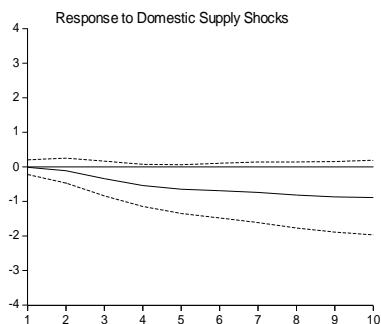
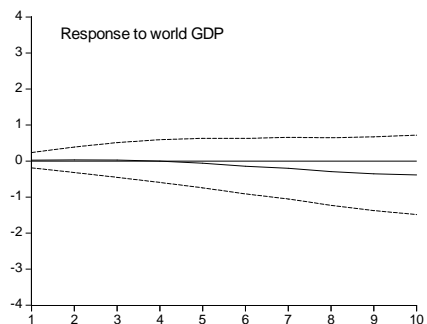
Inflation Responses



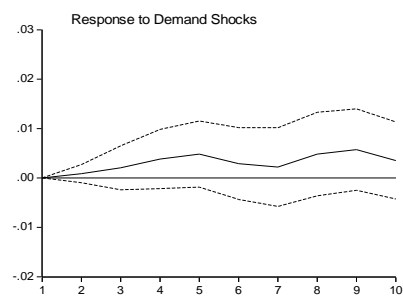
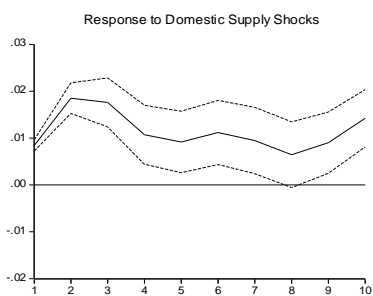
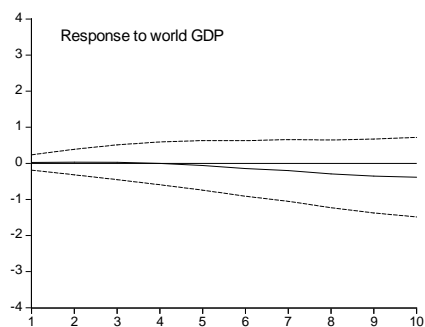
(6) Egypt Real GDP Responses



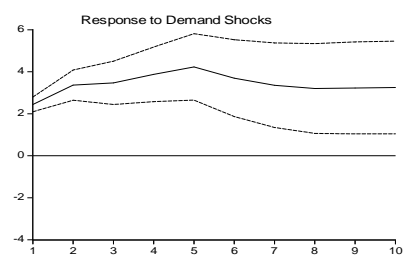
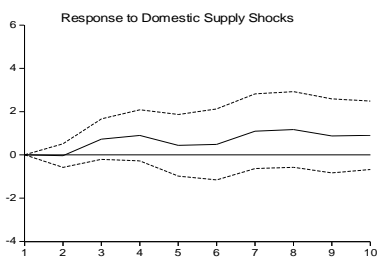
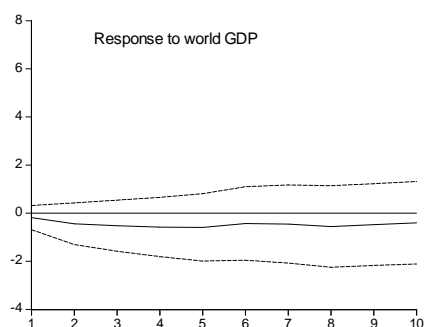
Inflation Responses



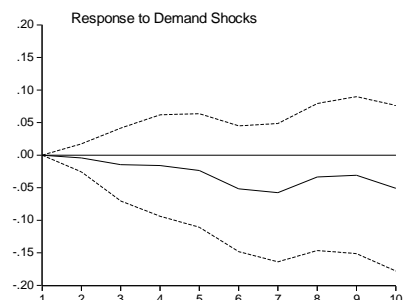
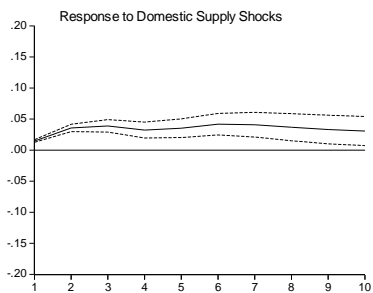
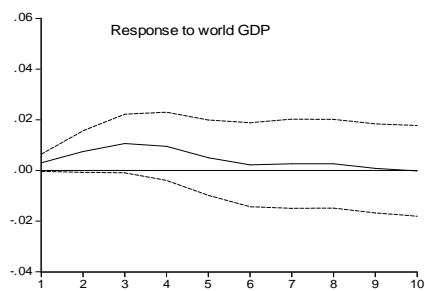
(7) Ethiopia Real GDP Responses



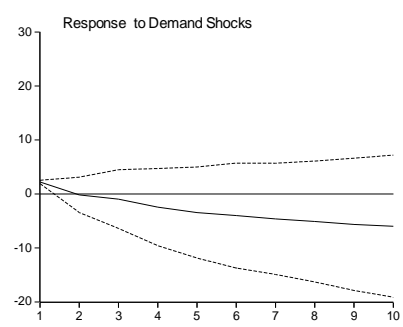
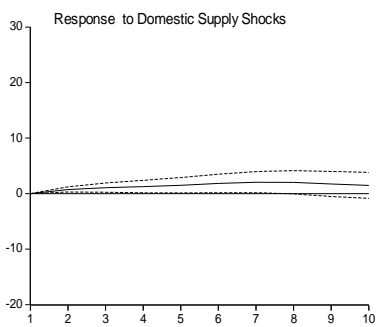
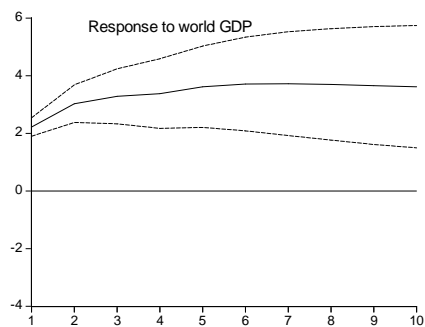
Inflation Responses



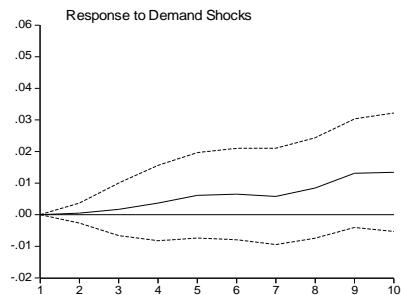
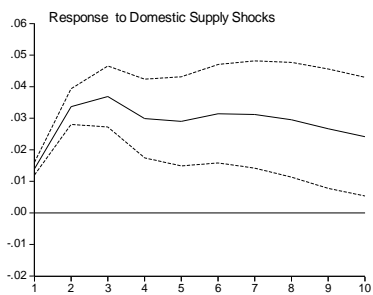
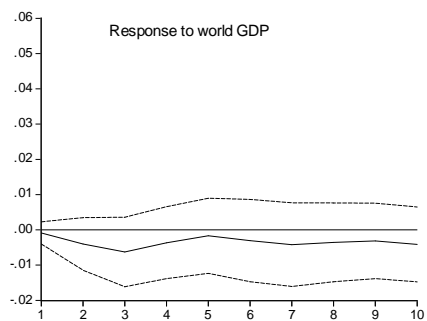
(8) Gabon Real GDP Responses



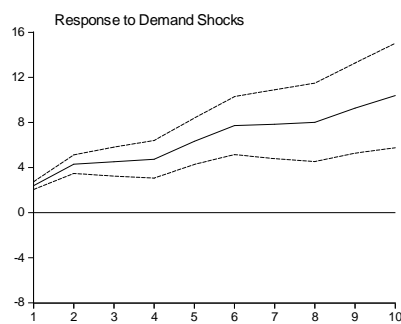
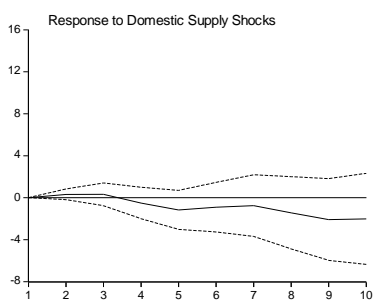
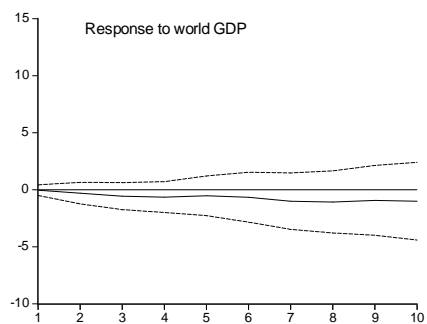
Inflation Responses



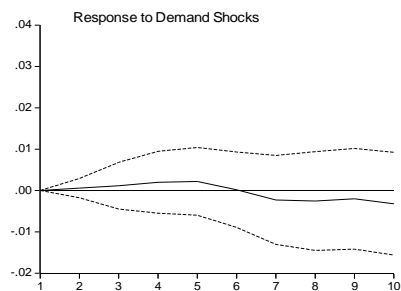
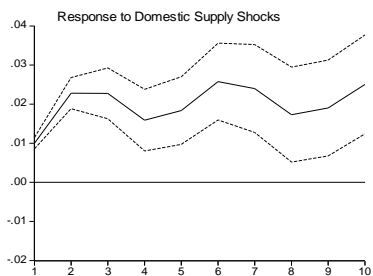
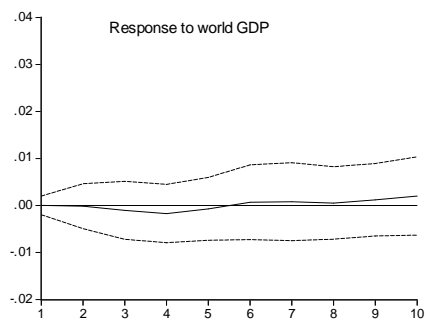
(9) Ghana Real GDP Responses



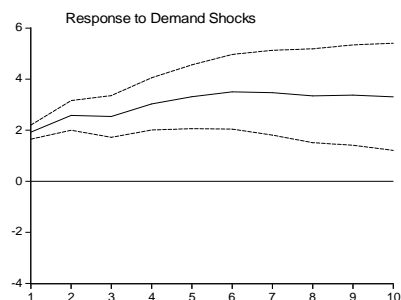
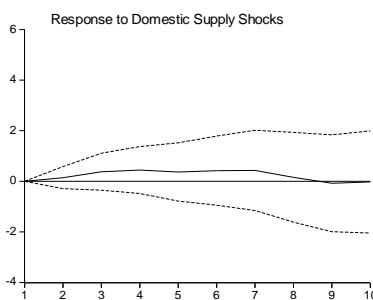
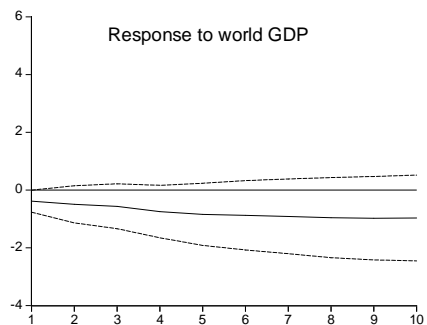
Inflation Responses



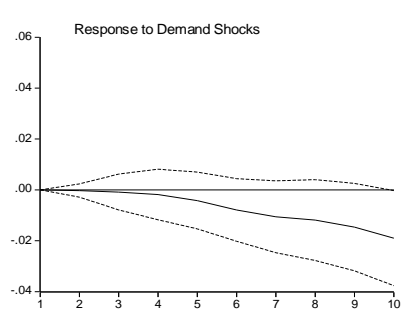
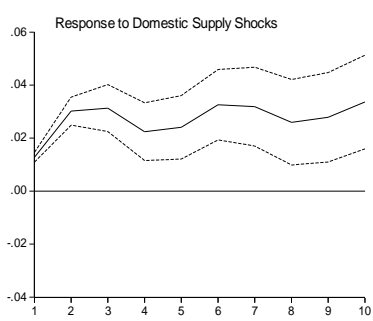
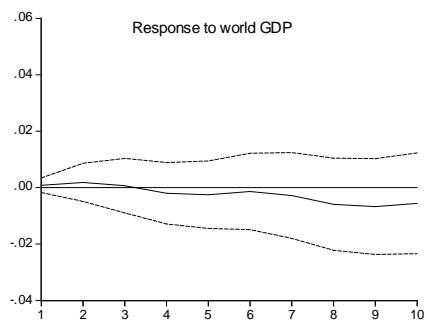
(10) Kenya Real GDP Responses



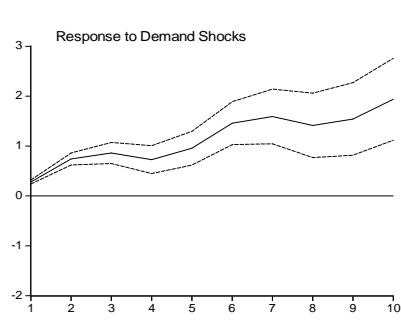
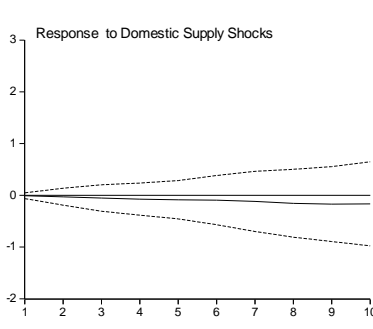
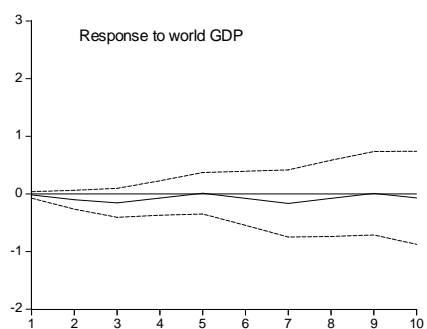
Inflation Responses



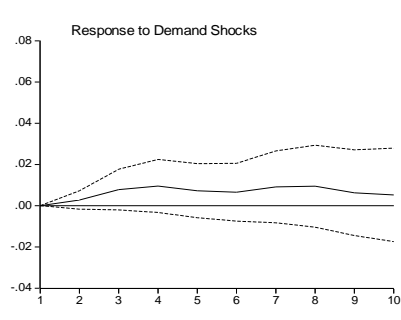
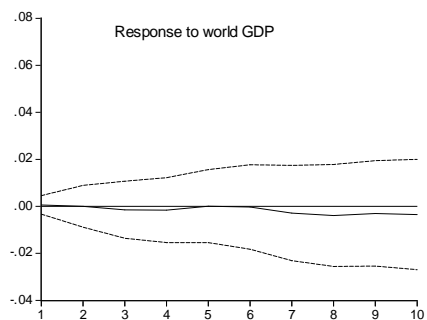
(11) Libya Real GDP Responses



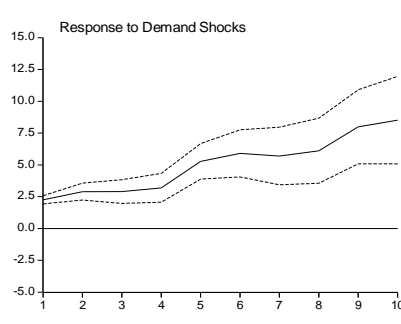
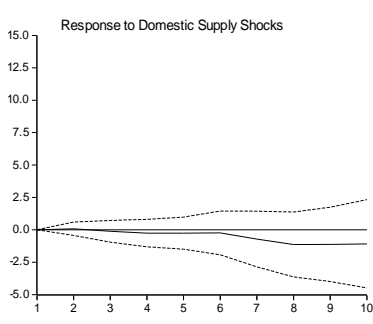
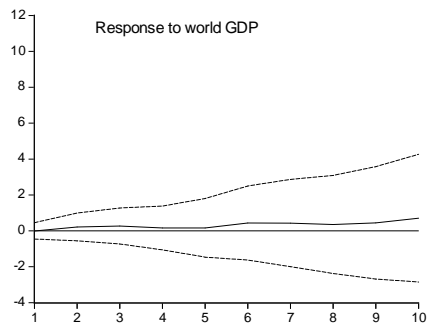
Inflation Responses



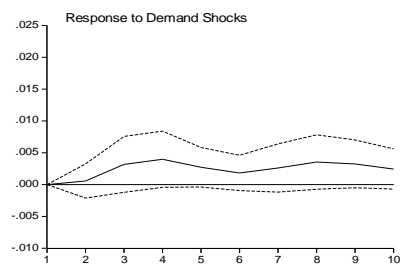
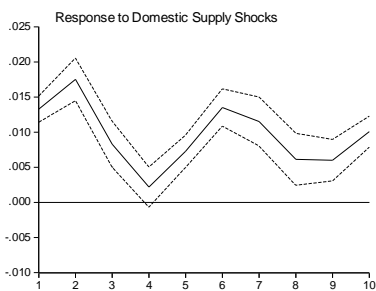
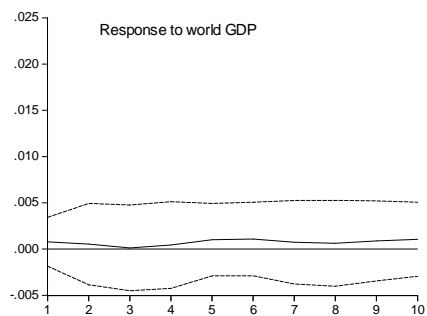
(12) Malawi Real GDP Responses



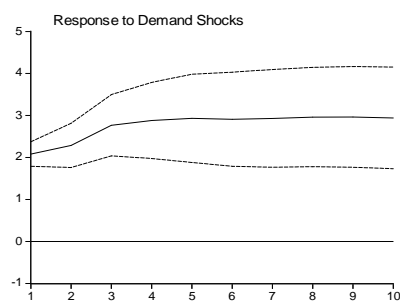
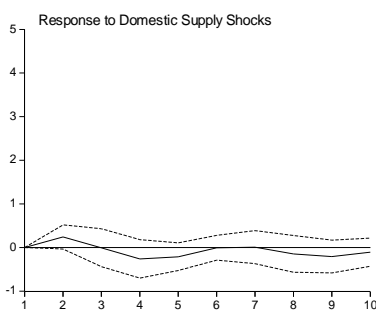
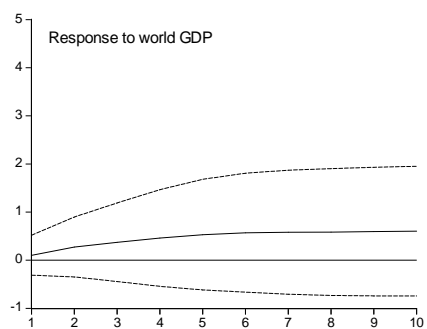
Inflation Responses



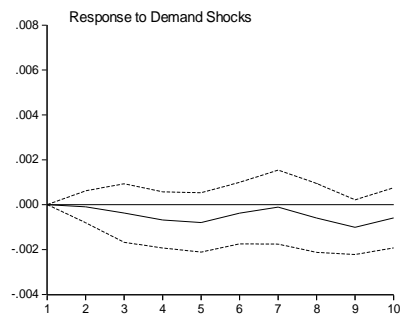
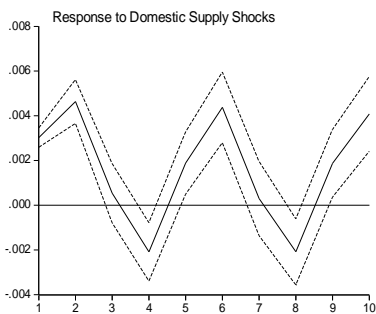
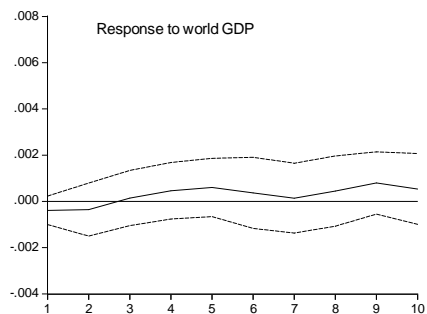
(13)Mauritania Real GDP Responses



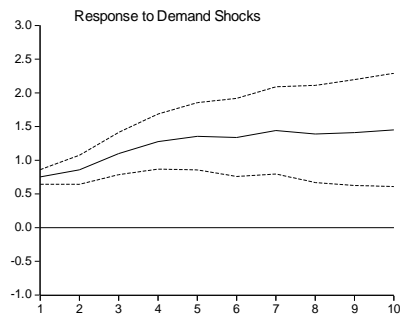
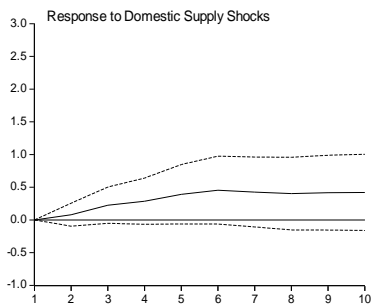
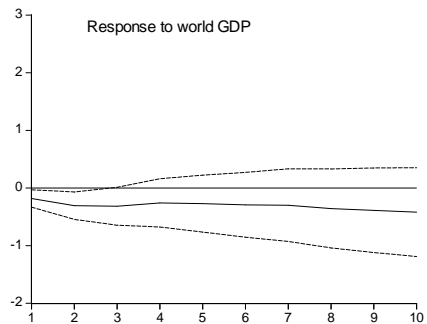
Inflation Responses



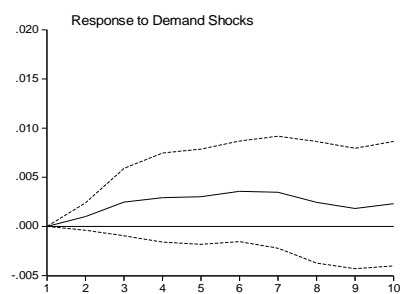
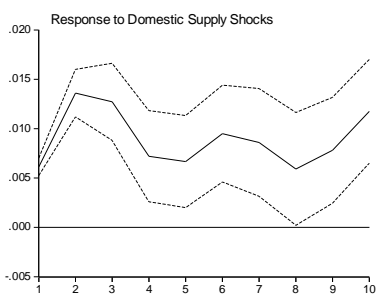
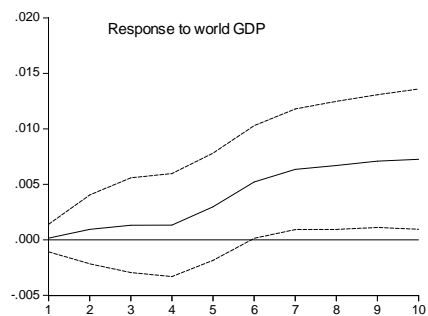
(14) Mauritius Real GDP Responses



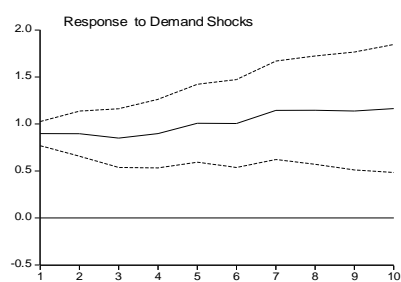
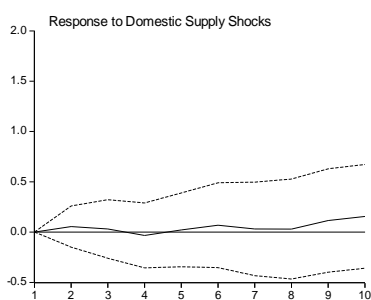
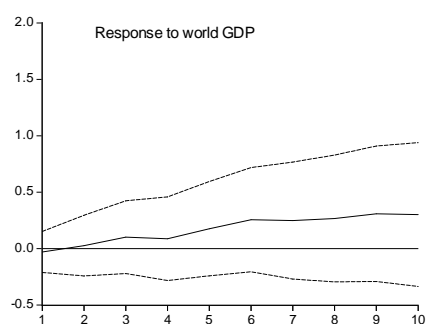
Inflation Responses



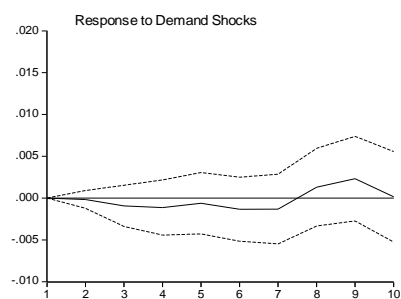
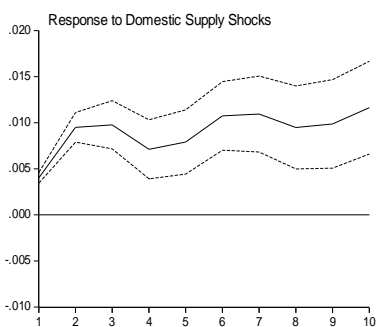
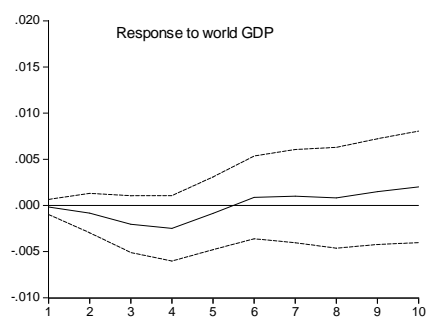
(15) Morocco Real GDP Responses



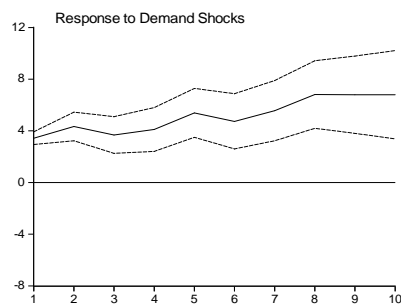
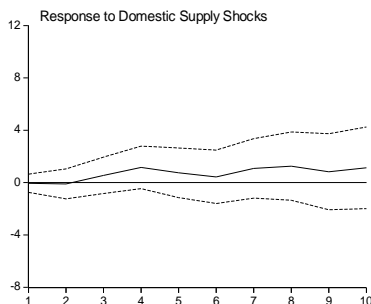
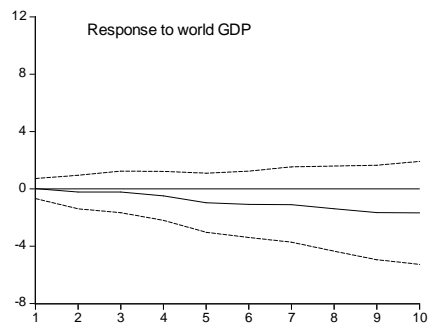
Inflation Responses



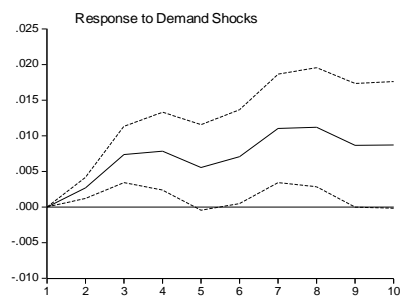
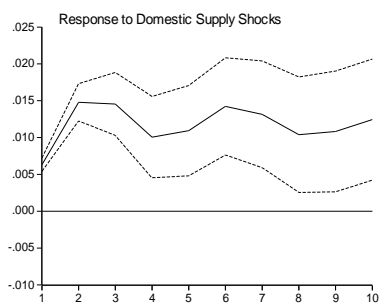
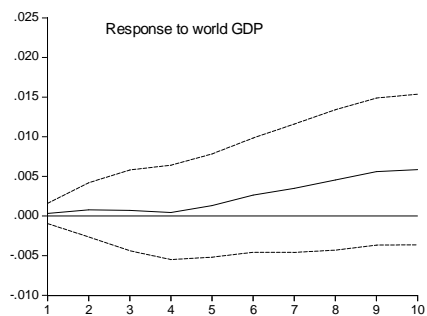
(16) Nigeria Real GDP Responses



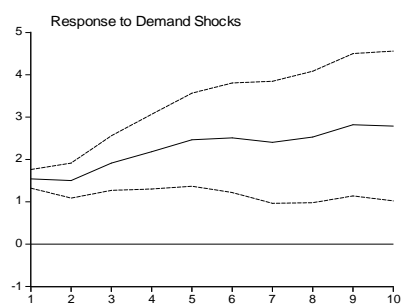
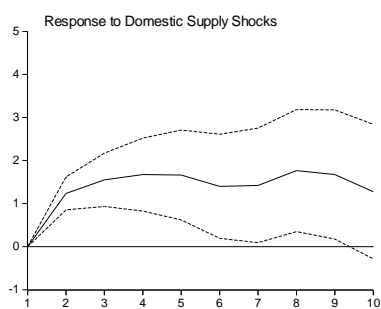
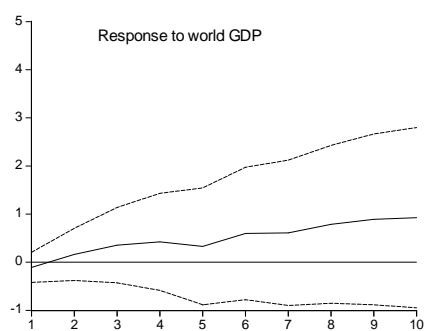
Inflation Responses



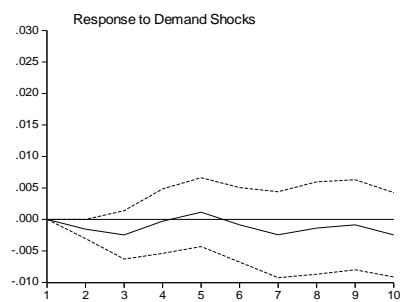
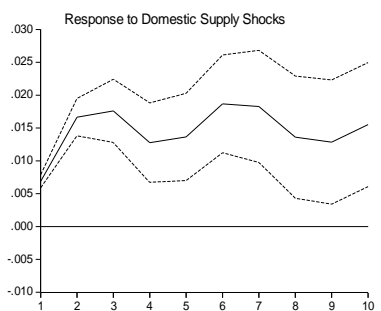
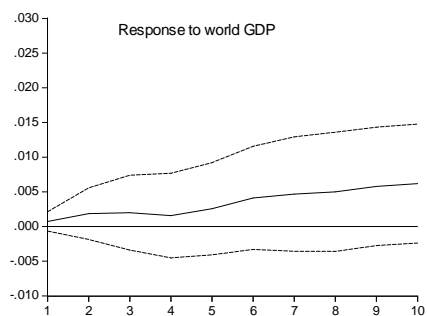
(17) Senegal Real GDP Responses



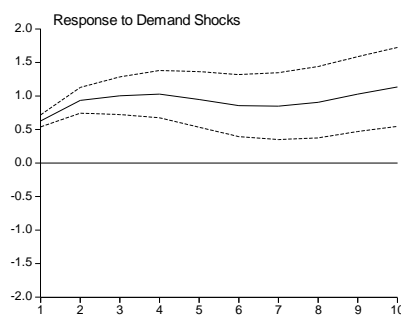
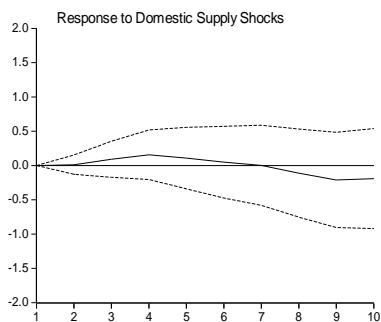
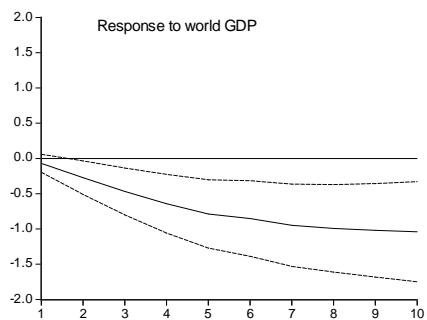
Inflation Responses



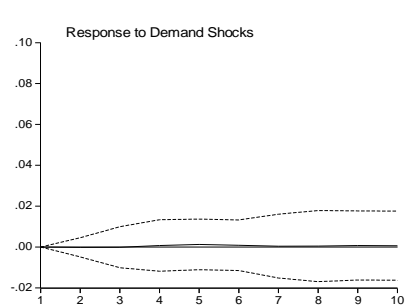
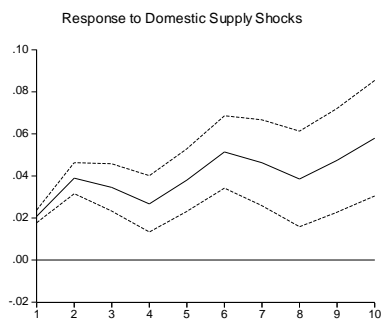
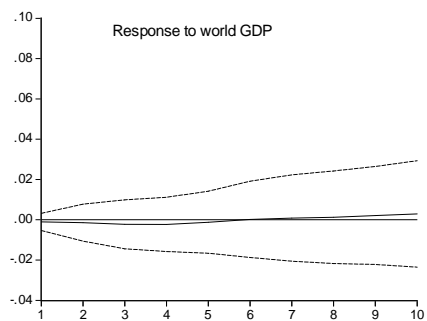
(18) South Africa Real GDP Responses



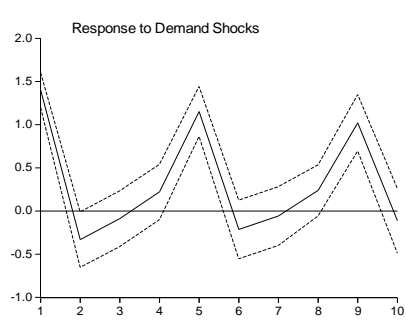
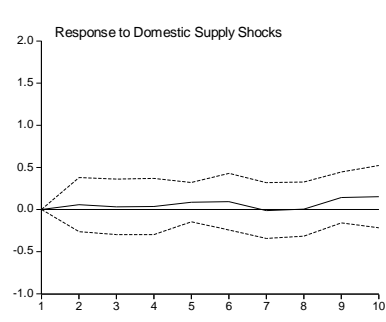
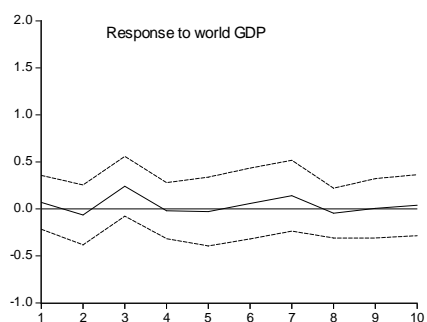
Inflation Responses



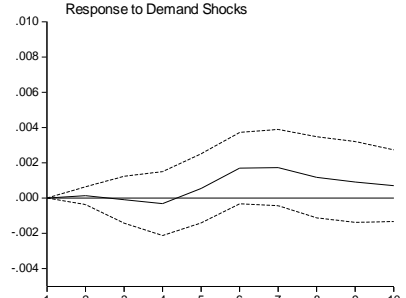
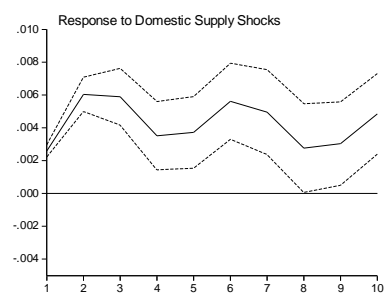
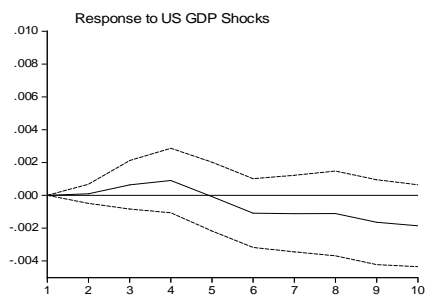
(19) Tanzania Real GDP Responses



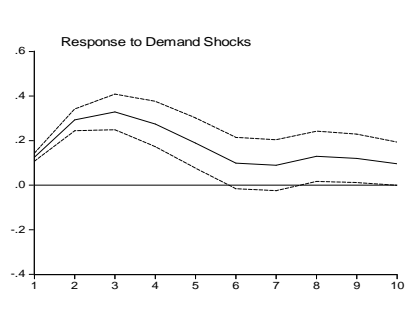
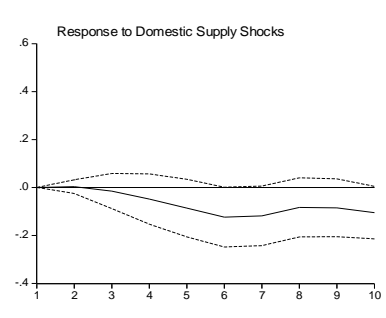
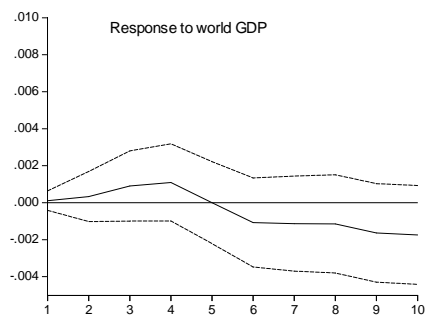
Inflation Responses



(20) Tunisia Real GDP Responses

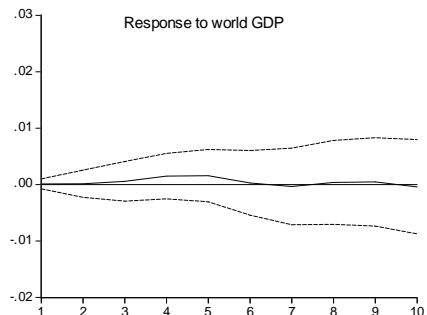


Inflation Responses

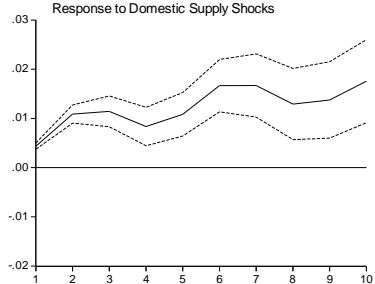


**(21) Uganda
Real GDP Responses**

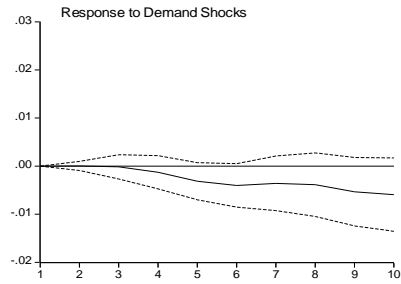
Response to world GDP



Response to Domestic Supply Shocks

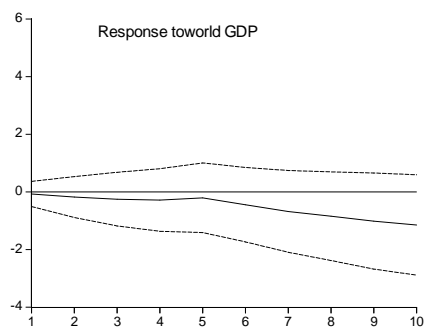


Response to Demand Shocks

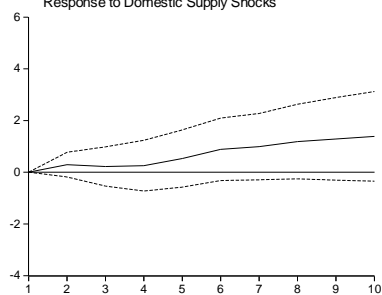


Inflation Responses

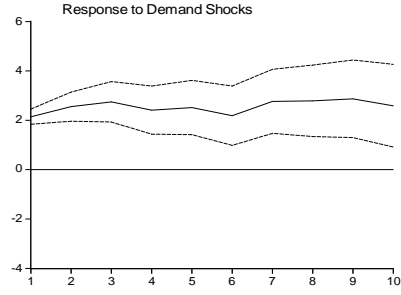
Response to world GDP



Response to Domestic Supply Shocks

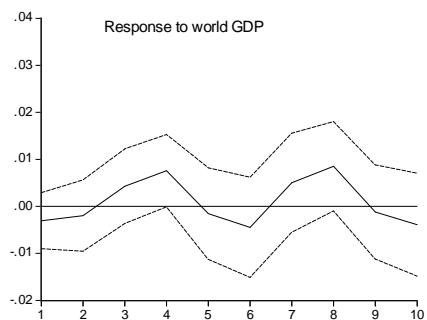


Response to Demand Shocks

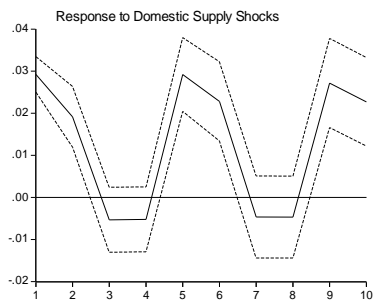


**(22) Zambia
Real GDP Responses**

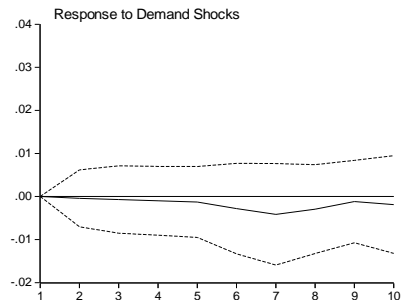
Response to world GDP



Response to Domestic Supply Shocks

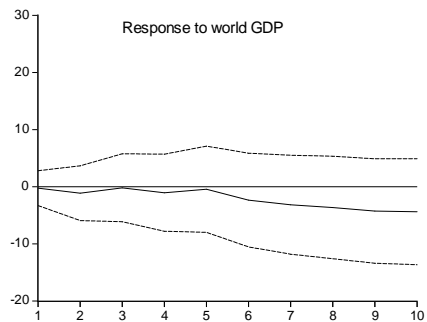


Response to Demand Shocks

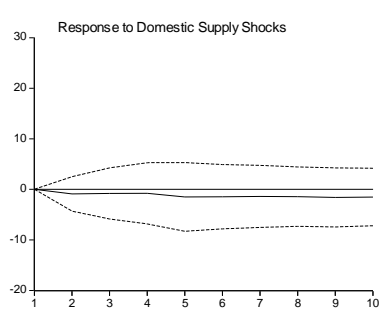


Inflation Responses

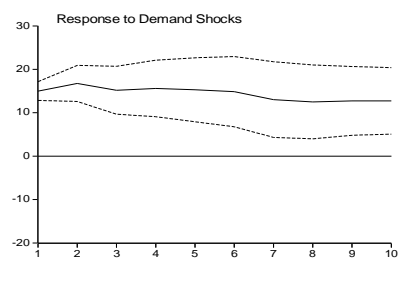
Response to world GDP



Response to Domestic Supply Shocks



Response to Demand Shocks



No.	Country	Variables	ADF		PP		KPSS		Johansen Cointegration Tests [‡]	
			Level	1 st Diff	Level	1 st Diff	Level	1 st Diff	Trace	Maximum Eigenvalues
1.	Algeria	LGDP	-1.39	-2.92 ^{**}	-2.16	-8.24 ^{**}	1.14 [#]	0.12	20.75	11.23
		LCPI	-1.66	-2.98 ^{**}	-0.16	-7.39 ^{**}	1.08 [#]	0.25		
2.	Benin	LGDP	-0.77	-2.91 ^{**}	-0.8	-7.40 ^{**}	1.12 [#]	0.10	28.23	18.58
		LCPI	-2.69	-8.44 ^{**}	-2.53	-21.85 ^{**}	2.02 [#]	0.00		
3.	Botswana	LGDP	-1.62	-5.01 ^{**}	-1.20	-8.35 ^{**}	1.13 [#]	0.20	28.13	16.55
		LCPI	-1.59	-6.07 ^{**}	-2.89	-10.68 ^{**}	0.47 [#]	0.12		
4.	Cameroun	LGDP	-1.89	-2.93 ^{**}	-1.97	-7.75 ^{**}	1.12 [#]	0.20	22.50	12.66
		LCPI	-0.83	-6.95 ^{**}	0.82	-6.94 ^{**}	1.12 [#]	0.08		
5.	Central Africa	LGDP	-1.78	-4.68 ^{**}	-2.34	-6.55 ^{**}	1.22 [#]	0.26	20.99	14.19
		LCPI	-1.06	-6.83 ^{**}	0.83	-6.82 ^{**}	1.12 [#]	0.06		
6.	Egypt	LGDP	-1.03	-3.05 ^{**}	-1.29	-10.26 ^{**}	1.14 [#]	0.16	23.40	13.04
		LCPI	-1.31	-6.68 ^{**}	-1.35	-6.79 ^{**}	1.14	0.32		
7.	Ethiopia	LGDP	-0.75	-3.50 ^{**}	-0.74	-7.60 ^{**}	1.15 [#]	0.16	25.30	17.41
		LCPI	-0.74	-4.53 ^{**}	-0.58	-7.37 ^{**}	1.23 [#]	0.14		
8.	Gabon	LGDP	-0.48	-4.34 ^{**}	-0.61	-6.70 ^{**}	1.19 [#]	0.05	27.12	17.83
		LCPI	-1.59	-6.69 ^{**}	-1.65	-6.73 ^{**}	1.12 [#]	0.09		
9.	Ghana	LGDP	-0.65	-4.32 ^{**}	-0.64	-5.52 ^{**}	0.90 [#]	0.14	28.39	20.85
		LCPI	3.41	-3.95 ^{**}	7.96	-5.42 ^{**}	1.02 [#]	0.31		
10.	Kenya	LGDP	-1.51	-4.76 ^{**}	-1.22	-8.51 ^{**}	1.14 [#]	0.22	26.31	16.89
		LCPI	-1.49	-7.65 ^{**}	-1.39	-7.63 ^{**}	1.17 [#]	0.06		
11.	Libya	LGDP	1.42	-4.00 ^{**}	-0.32	-7.35 ^{**}	1.15 [#]	0.04	23.50	16.24
		LCPI	-1.82	-2.94 ^{**}	-1.75	-7.70 ^{**}	1.07 [#]	0.03		
12.	Malawi	LGDP	0.28	-3.85 ^{**}	0.58	-8.43 ^{**}	1.13 [#]	0.22	21.46	13.54
		LCPI	-0.72	-4.71 ^{**}	5.73	-8.78 ^{**}	1.01 [#]	0.23		
13.	Mauritania	LGDP	-0.35	-4.10 ^{**}	-0.01	-8.24 ^{**}	1.15 [#]	0.05	19.78	14.21
		LCPI	2.08	-8.69 ^{**}	1.98	-8.79 ^{**}	1.20 [#]	0.32		
14.	Mauritius	LGDP	-0.30	-4.32 ^{**}	-0.86	-12.26 ^{**}	1.14 [#]	0.11	18.26	12.93
		LCPI	3.78	-7.70 ^{**}	3.18	-8.02 ^{**}	1.13 [#]	0.21		
15.	Morocco	LGDP	-1.26	-4.77 ^{**}	-0.89	-9.67 ^{**}	1.11 [#]	0.04	25.17	18.18
		LCPI	-2.46	-9.60 ^{**}	-2.63	-9.64 ^{**}	1.13 [#]	0.09		
16.	Nigeria	LGDP	0.23	-3.18 ^{**}	1.03	-6.33 ^{**}	1.07 [#]	0.42	28.96	16.47
		LCPI	0.50	-8.57 ^{**}	0.56	-8.49 ^{**}	1.12 [#]	0.07		
17.	Senegal	LGDP	0.35	-3.79 ^{**}	-0.01	-7.40 ^{**}	1.24 [#]	0.09	21.87	14.44
		LCPI	-1.25	-8.54 ^{**}	-1.22	-8.63 ^{**}	1.18 [#]	0.09		
18.	South Africa	LGDP	-2.76	-3.79 ^{**}	-2.41	-7.39 ^{**}	1.24 [#]	0.07	24.19	14.81
		LCPI	-2.87	-5.47 ^{**}	-2.04	-5.13 ^{**}	1.13 [#]	0.01		
19.	Tanzania	LGDP	-1.90	-4.28 ^{**}	-1.46	-8.60 ^{**}	1.12 [#]	0.30	22.42	14.97
		LCPI	-2.69	-5.18 ^{**}	0.93	-10.14 ^{**}	1.08 [#]	0.32		
20.	Tunisia	LGDP	1.10	-4.08 ^{**}	1.06	-8.58 ^{**}	1.14 [#]	0.22	19.67	11.72
		LCPI	-0.65	-4.83 ^{**}	-0.56	-5.12 ^{**}	1.19 [#]	0.12		
21.	Uganda	LGDP	-0.86	-3.08 ^{**}	-0.39	-7.86 ^{**}	1.10 [#]	0.09	27.63	17.98
		LCPI	0.79	-8.28 ^{**}	0.57	-8.35 ^{**}	1.11 [#]	0.27		
22.	Zambia	LGDP	-1.66	-6.08 ^{**}	-0.56	-8.75 ^{**}	1.12 [#]	0.20	27.92	20.58
		LCPI	0.49	-9.08 ^{**}	-0.39	-9.09 ^{**}	1.15 [#]	0.23		

^{**} and [#] signify rejection of the null at 5% level of significance.

[‡]The tests have failed to reject the null of no cointegration at 5% significance level in all the countries.

Table 2
Variance Decompositions

(1) Algeria				(2) Benin		
Variance Decomposition of GDP Due to:				Variance Decomposition of GDP Due to:		
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks
1	0.697599	99.30240	0.000000	0.135179	99.86482	0.000000
4	1.319167	95.81604	2.864796	1.123328	86.74560	12.13107
8	1.121261	94.82389	4.054847	3.661426	83.33741	13.00117
12	0.974957	93.65991	5.365129	3.730439	82.21944	14.05013
20	0.848007	91.06307	8.088923	3.738947	82.15733	14.10372
30	0.796416	89.11219	10.09139	3.755063	82.03315	14.21178
Variance Decomposition of Inflation Due to:				Variance Decomposition of Inflation Due to:		
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks
1	1.314343	0.404809	98.28085	3.352159	0.383648	96.26419
4	1.912087	3.802834	94.28508	3.391468	26.16956	70.43898
8	2.096226	11.47596	86.42781	3.096229	35.58237	61.32140
12	2.159426	16.84905	80.99153	3.308824	35.62448	61.06669
20	2.077913	21.46978	76.45231	3.315946	35.96312	60.72094
30	1.999664	23.84811	74.15223	3.318753	35.98966	60.69158
(3) Botswana				(4) Cameroon		
Variance Decomposition of GDP Due to:				Variance Decomposition of GDP Due to:		
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks
1	3.139049	96.86095	0.000000	0.152395	99.84760	0.000000
4	8.959465	86.92816	4.112373	2.450423	96.08224	1.467342
8	8.157334	83.34474	8.497930	2.936212	93.66187	3.401922
12	8.022418	84.54211	7.435471	3.099937	92.44003	4.460034
20	8.071869	84.96298	6.965149	3.262621	91.57599	5.161386
30	8.018019	85.30063	6.681352	3.310156	91.36872	5.321122
Variance Decomposition of Inflation Due to:				Variance Decomposition of Inflation Due to:		
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks
1	1.728150	0.223229	98.04862	0.760715	0.062224	99.17706
4	4.632431	4.455278	90.91229	2.392645	3.072200	94.53516
8	6.337457	5.090593	88.57195	3.831946	7.019245	89.14881
12	6.770689	5.064453	88.16486	4.277224	8.284746	87.43803
20	6.994070	5.145714	87.86022	4.312025	8.726697	86.96128
30	7.015931	5.157453	87.82662	4.309978	8.854381	86.83564
(5) Central Africa Republic				(6) Egypt		
Variance Decomposition of GDP Due to:				Variance Decomposition of GDP Due to:		
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks
1	2.154552	97.84545	0.000000	1.189876	98.81012	0.000000
4	2.464903	93.89102	3.644080	5.778992	91.18669	3.034320
8	5.944772	88.48952	5.565709	11.61283	80.78628	7.600884
12	6.074277	88.12934	5.796381	11.68917	80.89487	7.415963
20	6.305047	87.84564	5.849310	11.89244	80.65995	7.447611
30	6.323049	87.82361	5.853340	11.97479	80.59596	7.429252
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks
1	0.738759	0.442552	98.81869	0.048876	0.013569	99.93756
4	1.750316	26.32616	71.92352	0.119168	7.888055	91.99278
8	3.067606	27.83053	69.10186	1.731025	9.046626	89.22235
12	4.721425	28.33871	66.93987	2.129253	9.465143	88.40560
20	4.866925	28.56622	66.56686	2.221445	9.820932	87.95762
30	4.883234	28.58933	66.52743	2.251901	9.920681	87.82742

Table 2 contd
Variance Decompositions

(7) Ethiopia				(8) Gabon		
Variance Decomposition of GDP Due to:				Variance Decomposition of GDP Due to:		
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks
1	0.479377	99.52062	0.000000	0.129712	99.87029	0.000000
4	8.352452	89.49849	2.149060	2.598500	97.09914	0.302362
8	7.513766	86.24275	6.243487	12.61881	84.34973	3.031462
12	6.514348	85.62970	7.855956	13.86917	82.35359	3.777237
20	5.911580	84.26661	9.821813	14.44197	81.66495	3.893079
30	5.600261	83.74670	10.65304	14.47827	81.61639	3.905349
Variance Decomposition of Inflation Due to:				Variance Decomposition of Inflation Due to:		
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks
1	0.287772	0.188646	99.52358	98.20162	0.007283	1.791096
4	2.414337	7.913673	89.67199	85.02673	11.25738	3.715884
8	3.797290	13.64155	82.56116	81.99757	13.97521	4.027224
12	5.575889	15.05473	79.36938	80.14147	15.76745	4.091085
20	5.519622	17.95117	76.52921	79.40028	16.39592	4.203797
30	5.405677	19.64493	74.94939	79.37767	16.41640	4.205926
(9) Ghana				(10) Kenya		
Variance Decomposition of GDP Due to:				Variance Decomposition of GDP Due to:		
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks
1	0.948023	99.05198	0.000000	0.409052	99.59095	0.000000
4	8.157540	91.04738	0.795084	0.371236	99.22212	0.406640
8	11.59851	85.84332	2.558164	1.611625	95.89511	2.493262
12	11.16919	82.76995	6.060863	1.781171	95.23749	2.981342
20	11.02019	80.46502	8.514792	1.729888	95.07788	3.192232
30	11.04960	79.38328	9.567118	1.677671	95.01054	3.311785
Variance Decomposition of Inflation Due to:				Variance Decomposition of Inflation Due to:		
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks
1	0.012081	0.988645	98.99927	6.619090	0.009465	93.37145
4	3.514152	7.484227	89.00162	8.119859	1.788591	90.09155
8	6.340093	11.69651	81.96340	9.843909	3.389220	86.76687
12	7.191480	12.97630	79.83222	10.33944	5.291002	84.36956
20	7.239602	13.29020	79.47020	10.17049	7.170474	82.65904
30	7.279925	13.48217	79.23791	10.07751	8.436345	81.48615
(11) Libya				(12) Malawi		
Variance Decomposition of GDP Due to:				Variance Decomposition of GDP Due to:		
Period	World GDP Shocks	Supply Shocks	Demand Shocks	US GDP Shocks	Supply Shocks	Demand Shocks
1	0.379312	99.62069	0.000000	0.089157	99.91084	0.000000
4	1.834764	97.92614	0.239100	0.327360	95.70023	3.972406
8	3.290019	92.54507	4.164909	1.141665	94.93488	3.923451
12	3.399166	88.75001	7.850828	1.228336	94.37930	4.392364
20	3.664106	86.29047	10.04543	1.363493	92.63320	6.003304
30	3.764561	85.52276	10.71268	1.415634	89.99254	8.591830
Variance Decomposition of Inflation Due to:				Variance Decomposition of Inflation Due to:		
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks
1	0.456643	0.104375	99.43898	0.000832	4.182117	95.81705
4	5.088087	0.448835	94.46308	1.098662	5.236041	93.66530
8	6.527052	0.507621	92.96533	1.272701	7.951434	90.77586
12	7.524410	0.661936	91.81365	1.397055	10.39482	88.20813
20	8.250193	1.055560	90.69425	1.619632	15.51283	82.86754
30	8.292084	1.379007	90.32891	1.922339	21.01767	77.05999

Table 2 contd
Variance Decompositions

(13) Mauritania				(14) Mauritius		
Variance Decomposition of GDP Due to:				Variance Decomposition of GDP Due to:		
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks
1	0.341140	99.65886	0.000000	1.650680	98.34932	0.000000
4	0.285520	97.32375	2.390734	1.439080	98.09559	0.465330
8	0.329365	96.93890	2.731730	0.917985	98.31001	0.772006
12	0.342350	96.84188	2.815767	0.913677	98.06674	1.019579
20	0.342441	96.82494	2.832623	0.893354	97.94582	1.160822
30	0.342566	96.82009	2.837345	0.871667	97.91429	1.214042
Variance Decomposition of Inflation Due to:				Variance Decomposition of Inflation Due to:		
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks
1	0.242112	0.041890	99.71600	5.892880	4.058424	90.04870
4	1.186943	3.776650	95.03641	7.667576	5.215885	87.11654
8	1.298330	5.096483	93.60519	7.821074	7.016395	85.16253
12	1.297166	5.512266	93.19057	8.396674	7.193949	84.40938
20	1.294359	5.766615	92.93903	8.374595	7.292513	84.33289
30	1.294100	5.793982	92.91192	8.372648	7.363108	84.26424
(15) Morocco				(16) Nigeria		
Variance Decomposition of GDP Due to:				Variance Decomposition of GDP Due to:		
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks
1	0.060205	99.93979	0.000000	0.183057	99.81694	0.000000
4	0.599076	96.87550	2.525420	3.775915	95.05124	1.172844
8	6.277502	90.80418	2.918315	9.732592	79.88312	10.38428
12	5.946612	91.06283	2.990558	9.303063	70.73596	19.96098
20	5.651234	91.26708	3.081684	9.260990	69.70403	21.03498
30	5.415327	91.49998	3.084696	9.039772	67.81870	23.14153
Variance Decomposition of Inflation Due to:				Variance Decomposition of Inflation Due to:		
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks
1	0.114766	2.535742	97.34949	0.001189	0.022156	99.97665
4	1.203512	3.337419	95.45907	0.938649	5.660758	93.40059
8	2.793708	3.999742	93.20655	2.342962	7.760214	89.89682
12	2.977792	5.100876	91.92133	2.695416	9.849148	87.45544
20	3.047471	6.072823	90.87971	2.527979	9.338862	88.13316
30	3.048741	6.582463	90.36880	2.409436	9.622358	87.96821
(17) Senegal				(18) South Africa		
Variance Decomposition of GDP Due to:				Variance Decomposition of GDP Due to:		
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks
1	0.259468	99.74053	0.000000	1.120657	98.87934	0.000000
4	0.223169	82.85547	16.92137	1.139210	94.32366	4.537125
8	2.193185	74.13200	23.67482	2.474951	90.07819	7.446864
12	2.564259	71.14698	26.28876	2.622265	88.72255	8.655189
20	2.486433	68.90421	28.60936	2.536647	88.23583	9.227519
30	2.428857	68.03732	29.53382	2.528947	88.11764	9.353412
Variance Decomposition of Inflation Due to:				Variance Decomposition of Inflation Due to:		
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks
1	0.502992	2.842035	96.65497	1.218182	0.009633	98.77218
4	2.873270	39.65645	57.47028	18.73362	1.758078	79.50830
8	4.965927	40.35368	54.68039	21.95426	4.570347	73.47540
12	4.823426	41.75256	53.42401	20.90553	6.176654	72.91781
20	4.626647	42.02510	53.34826	21.07563	6.653437	72.27094
30	4.520969	42.07036	53.40868	21.05664	6.749669	72.19370

Table 2 contd
Variance Decompositions

(19) Tanzania				(20) Tunisia			
Variance Decomposition of GDP Due to:				Variance Decomposition of GDP Due to:			
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks	
1	0.267935	99.73206	0.000000	0.177848	99.82215	0.000000	
4	0.235151	99.67094	0.093909	1.716712	97.81600	0.467286	
8	0.464650	99.42163	0.113725	7.262075	86.36504	6.372888	
12	0.469849	99.41750	0.112648	7.446272	86.47764	6.076086	
20	0.404623	99.43677	0.158602	7.150791	87.03960	5.809606	
30	0.363671	99.34512	0.291212	7.101498	87.44934	5.449165	
Variance Decomposition of Inflation Due to:				Variance Decomposition of Inflation Due to:			
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks	
1	0.243317	0.304568	99.45211	1.782702	0.000271	98.21703	
4	3.461808	0.153008	96.38518	1.972222	2.922940	95.10484	
8	2.831523	0.413912	96.75456	2.893487	7.738044	89.36847	
12	2.507026	1.062736	96.43024	3.032093	10.30799	86.65991	
20	2.212598	3.434465	94.35294	3.275172	10.76633	85.95849	
30	1.985756	7.228150	90.78609	3.330233	11.54321	85.12655	
(21) Uganda				(22) Zambia			
Variance Decomposition of GDP Due to:				Variance Decomposition of GDP Due to:			
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks	
1	0.051005	99.94899	0.000000	1.099030	98.90097	0.000000	
4	1.418046	96.82325	1.758707	3.789984	96.18779	0.022223	
8	2.676919	93.01603	4.307050	6.791105	93.04929	0.159609	
12	3.223317	91.49613	5.280556	7.981458	91.77073	0.247812	
20	3.501586	90.95756	5.540850	8.793665	90.79196	0.414371	
30	3.566082	90.85069	5.583232	9.150702	90.35322	0.496081	
Variance Decomposition of Inflation Due to:				Variance Decomposition of Inflation Due to:			
Period	World GDP Shocks	Supply Shocks	Demand Shocks	World GDP Shocks	Supply Shocks	Demand Shocks	
1	0.124065	0.246888	99.62905	0.030485	0.008646	99.96087	
4	0.460843	2.260634	97.27852	1.068879	0.375578	98.55554	
8	2.866493	6.197755	90.93575	3.043479	0.575072	96.38145	
12	3.572738	6.788654	89.63861	3.209379	0.592822	96.19780	
20	3.567315	6.762468	89.67022	3.246050	0.614153	96.13980	
30	3.554947	6.746145	89.69891	3.247690	0.632784	96.11953	

Table 3 Partial Correlation Analysis			
No.	Country	Supply	Demand
1.	Algeria	0.28 (2.97)	-0.28 (-2.90)
2.	Benin	0.18 (1.87)	-0.11 (-1.12)
3.	Botswana	0.53 (6.22)	-0.40 (-4.36)
4.	Cameroon	0.08 (0.81)	-0.08 (-0.81)
5.	Central Africa	-0.26 (-2.65)	0.22 (2.27)
6.	Egypt	0.39 (4.25)	-0.36 (-3.83)
7.	Ethiopia	0.28 (2.92)	-0.35 (-3.78)
8.	Gabon	0.08 (0.82)	0.22 (2.25)
9.	Ghana	0.59 (7.30)	-0.69 (-9.61)
10.	Kenya	0.04 (0.40)	-0.03 (-0.26)
11.	Libya	0.48 (5.50)	-0.50 (-5.67)
12.	Malawi	0.94 (27.96)	-0.95 (-30.05)
13.	Mauritania	0.17 (1.69)	-0.16 (-1.67)
14.	Mauritius	0.75 (11.23)	-0.76 (-11.63)
15.	Morocco	-0.44 (-4.94)	0.46 (5.26)
16.	Nigeria	0.47 (5.35)	-0.51 (-5.94)
17.	Senegal	0.01 (0.09)	-0.01 (-0.12)
18.	South Africa	0.46 (5.43)	-0.50 (-5.73)
19.	Tanzania	0.23 (2.42)	-0.23 (-2.32)
20.	Tunisia	0.21 (2.17)	-0.18 (-1.83)
21.	Uganda	0.53 (6.23)	-0.45 (-5.09)
22.	Zambia	0.39 (4.30)	-0.52 (-6.11)
Figures in the parenthesis are t-ratios			